# Intra-body nano-network

## Brief summary

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Translated by Orwell City
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# Diagram of the intra-body nano-network

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- The nano-network is a set of objects and elements with the **ability to interact with each other through signals** in the form of pulses, electromagnetic waves, and electric fields, being also able to operate in the molecular spectrum.
- These components may be **already assembled or pending self-assembly** when the conditions of temperature, magnetism, and environment are suitable.
- Within the nano-network, two types or strands can be distinguished:

1. **The one that is fixed in the brain**
2. **The one that is fixed in the rest of the body**

# Diagram of the intra-body nano-network

**Brain nano-network**

- It aims to form a neuronal **interface to interact with the cognitive, physical, and electrical processes of brain activity** for neuromodulation, neurostimulation, and neurocontrol.
- This requires the introduction of carbon nanotubes that serve to **link neurons, shortening the natural distance of axons**. This can also be achieved with graphene quantum dots and graphene nanosheets, although the literature makes explicit that single-walled carbon nanotubes SWCNT or multi-walled carbon nanotubes MWCNT are the key element.
- The carbon nanotubes together with the hydrogel in which they are coated **act as electrodes, picking up the fluctuations of the electrical activity of the neurons**, with sufficient sensitivity to determine the segregation of neurotransmitters.

# Diagram of the intra-body nano-network

- Electrical activity can be transmitted through the carbon nanotubes as **signals triggered by the molecular activity of the surrounding brain tissue** so that a map of the individual's brain activity can be obtained in real-time.
- Since the carbon nanotubes are tubular graphene structures, they can propagate the electrical signals to other components of the nano-network. These are the nearest nanorouter or nanocontrollers.
- The nanorouters are responsible for **receiving the electrical signal, decoding it, configuring the data packets and the recipient of the information**, providing MAC identification and a destination IP address. Additionally, this information can be encrypted to increase the security of the system and prevent bio-hacking.
- A nano-interface is required to transmit the signal outside the body, which could have several functions, on the one hand, the encryption of the data packets and, on the other hand, to increase the frequency, so that it can be **propagated outside the body at an enough distance**.

# Diagram of the intra-body nano-network

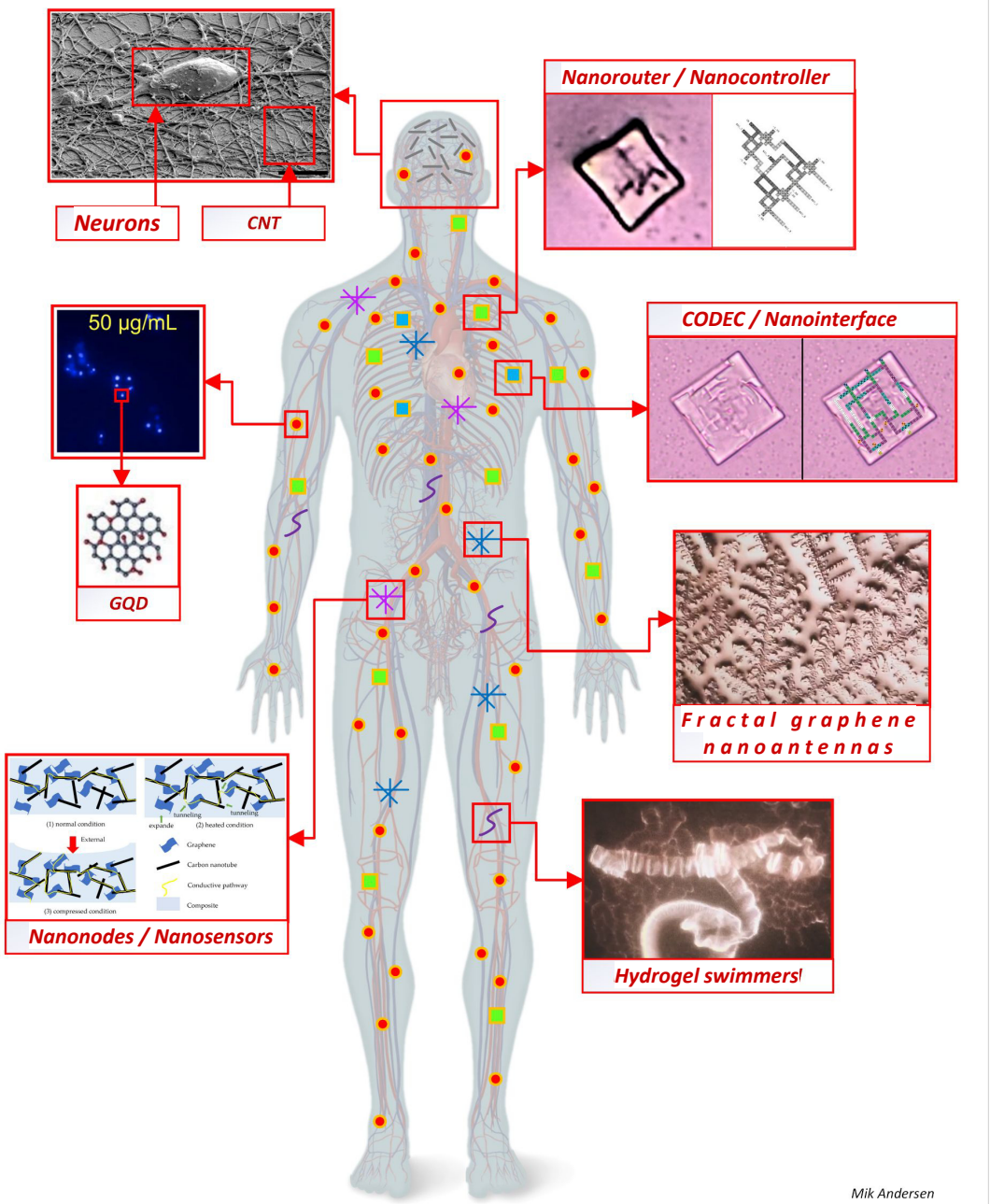
**Body nano-network**

- As opposed to the brain nano-network, **it doesn't require carbon nanotubes to operate and can be based entirely on the theory of electromagnetic communication**. Note that the brain nano-network additionally works on molecular communication.
- This network **employs all kinds of nano-devices and nano-nodes**. In particular, graphene GQD quantum dots, but also nano-devices or nano-sensors made of hydrogel, carbon nanotubes, and graphene sheets (not necessarily pre-formed).
- All components, whether nano-sensors, nano-devices, or GQD graphene quantum dots, **can transmit and repeat signals** so that they act as nano-antennas, transmitters, and receivers, in target organs and tissues.

# Diagram of the intra-body nano-network

- The **possible data that can be obtained** are vital signs, cardiac activity, respiratory activity, blood composition, degree of oxygenation, etc. The literature describes a multitude of nano-sensors based on graphene and carbon nanotubes, among other components.
- They are obtained thanks to graphene GQD quantum dots, which circulate through the bloodstream, arteries, capillaries... These components are electrically **charged and can transport proteins** due to their adsorptive capacity. When passing near a fixed/attached biosensor in the human body (e.g. a network of carbon nanotubes with graphene nanosheets forming a simple circuit or transistor), it generates a potential differential and thus a signal that can be interpreted and transmitted. Don't forget the ability of the nanomaterial to act as nano-antennas.
- The signals are transmitted to the nearest nanocontroller or nanorouter, reproducing the same signal **propagation process, to the outside of the body** through a component that acts as a nano-interface.

## *Esquema de la nano-red intra-corporal*




This diagram shows all the components that are introduced with each inoculation. Together, they act as a network for monitoring the human body.

### Intracorporal nano-network components

1. Carbon nanotubes and derivatives CNT, SWCNT, MWCNT
2. Graphene quantum dots GQD
3. Hydrogel swimmers
4. Fractal graphene nanoantennas
5. Nanorouter or Nanocontrollers
6. CODEC or Nanointerface

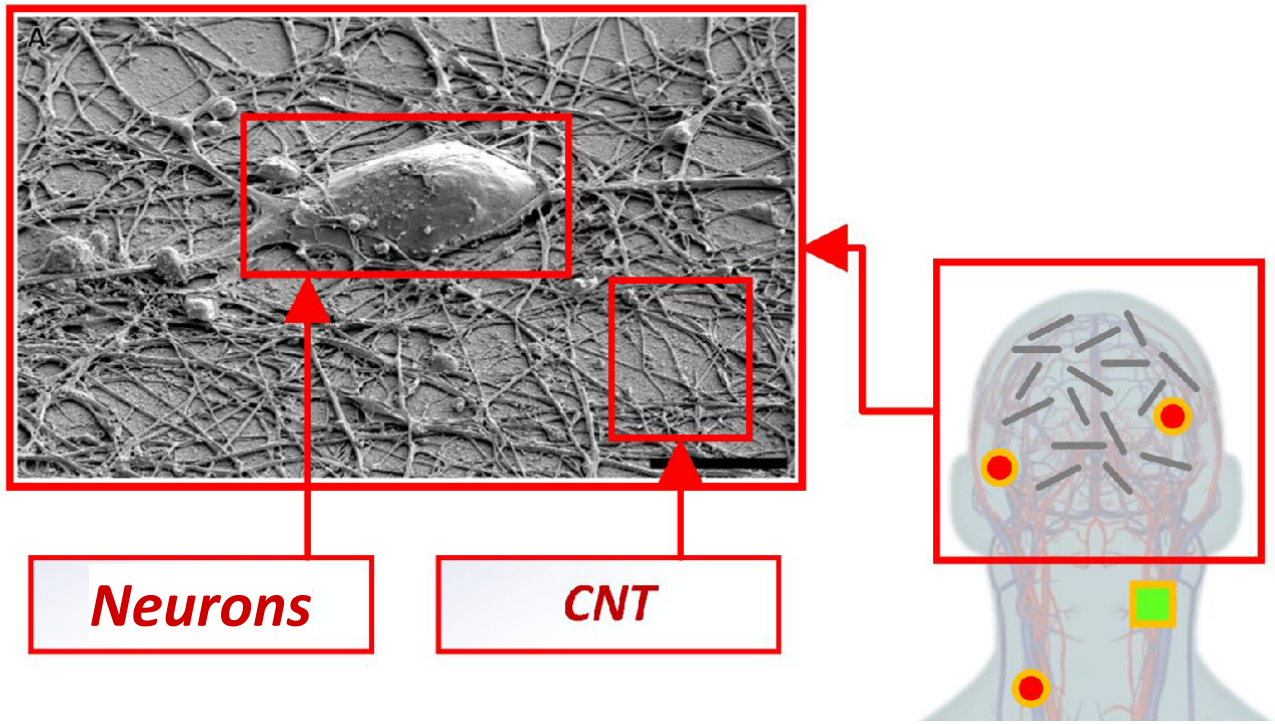
### Nano-network topology

1. Nano-nodes (GQD, Hydrogel swimmers, Nanotubes, Fibers)
2. Nano-sensors (Nanotube circuits, graphene nanosheets)
3. Nano-controllers (QCA nanorouter circuits)
4. Nano-interface (QCA nanoCODEC circuits)
5. => Communication with the outside =>

# Analysis of the intra-body network components

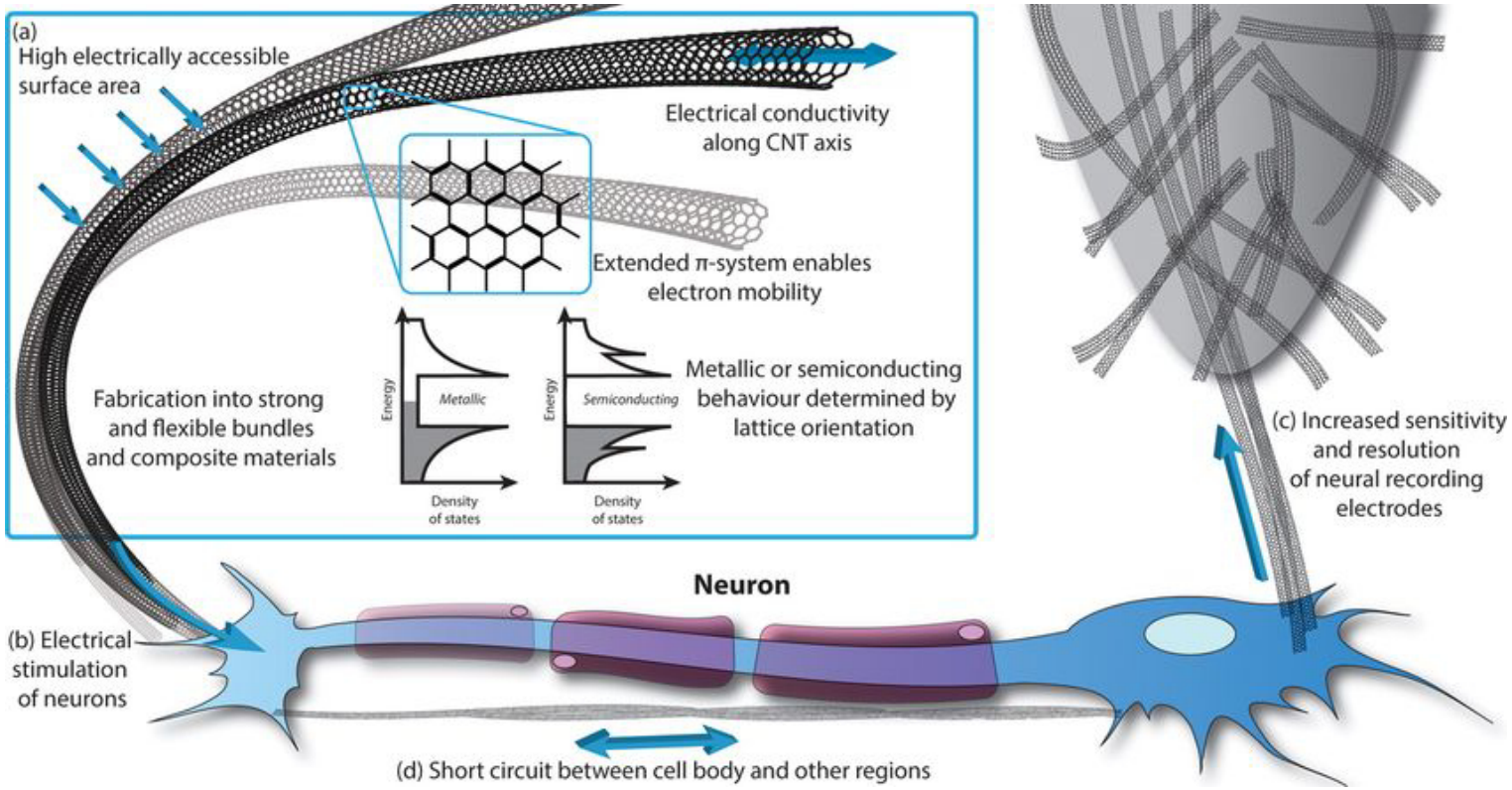
# Analysis of the intra-body network components

**Carbon nanotubes in the brain**




- Carbon nanotubes generate a mesh over the natural neuronal network, which makes it possible to **infer the synapse and interfere in its functioning** using the appropriate stimuli.
- New connection routes between neurons are also generated, which **means that the natural networks are no longer used** in favor of the new structure, allowing neuromodulation, neurostimulation, and monitoring of the individual's neuronal activity.

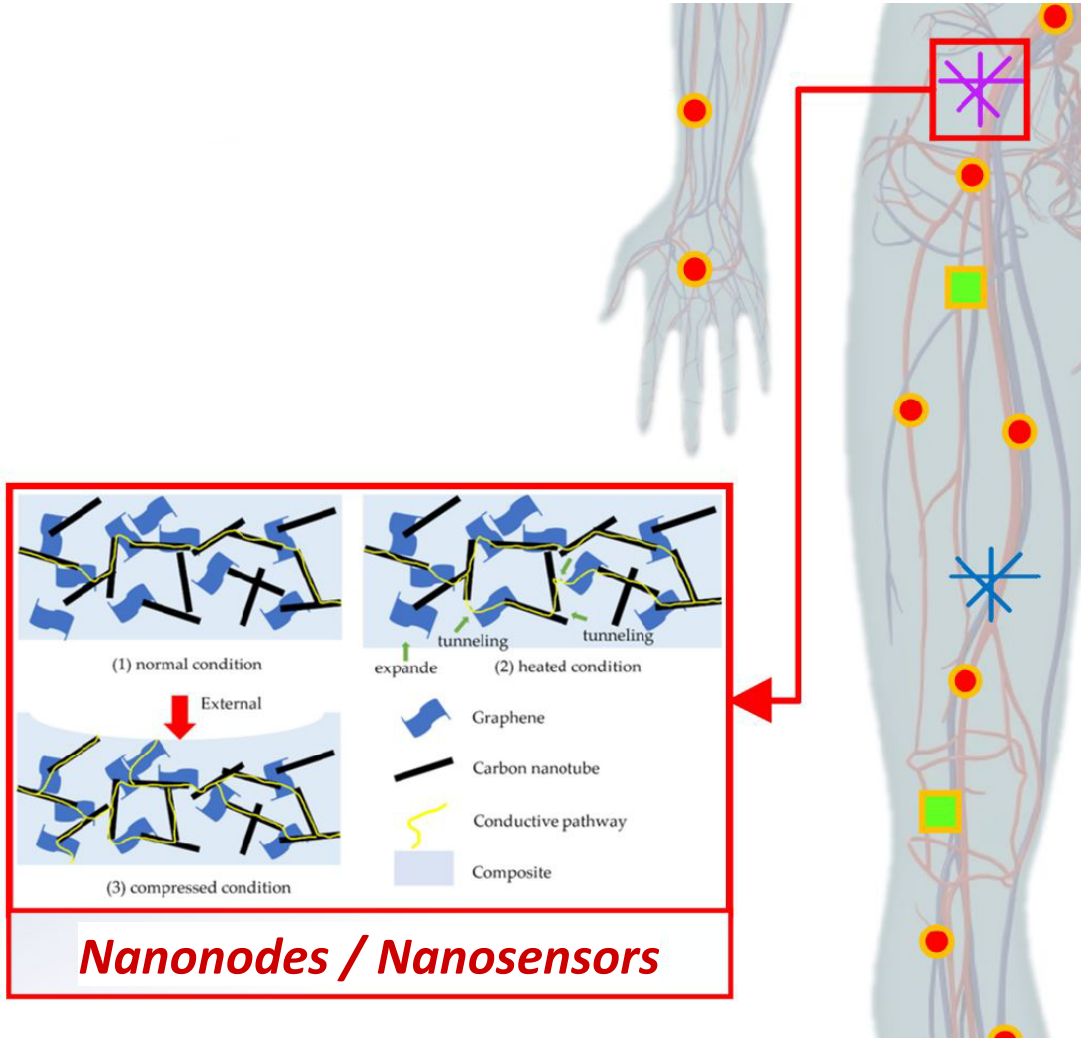
# Analysis of the intra-body network components



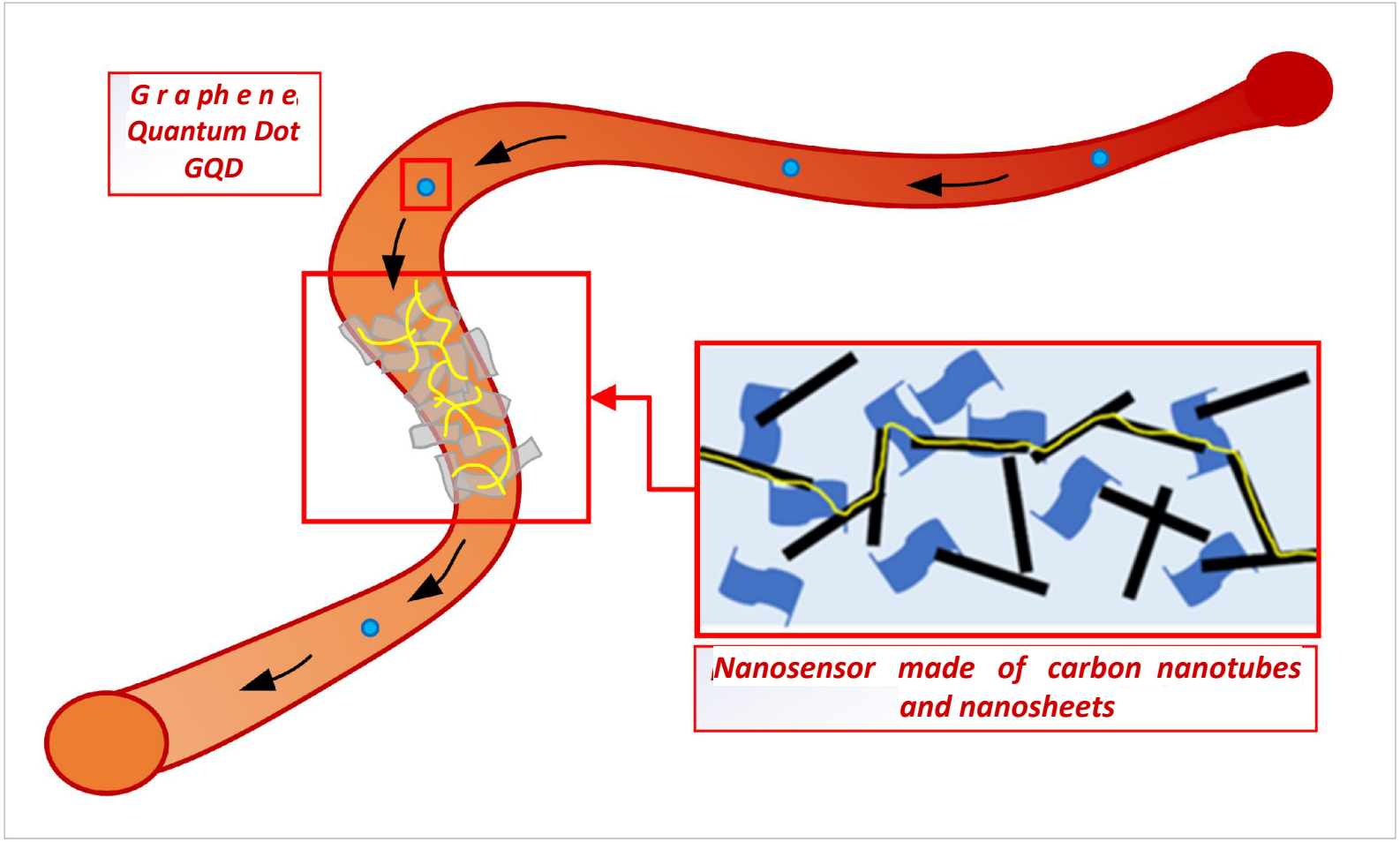

- This diagram shows how the nanotubes **act as electrodes** with which the neurons are stimulated.
- Since the graphene with which the **CNTs are formed is a superconductor**, it serves as an artificial axon.
- It shouldn't be omitted that the network of CNTs together with hydrogels **can form circuits** with which to obtain and propagate the signal from the neurons.

# Analysis of the intra-body network components

- **Nanosensors can be formed** in any part of the body, not only in the brain. Fundamentally, in the endothelium and the walls of blood vessels.
- These nanosensors don't have a predefined shape. **Their organization is chaotic, although they form conductive routes** to transmit electrical signals of potential differential. This happens when a GQD (graphene quantum dot) approaches the nanosensor.
- Since nanosensors **can propagate signals**, they transmit any potential difference as a signal.

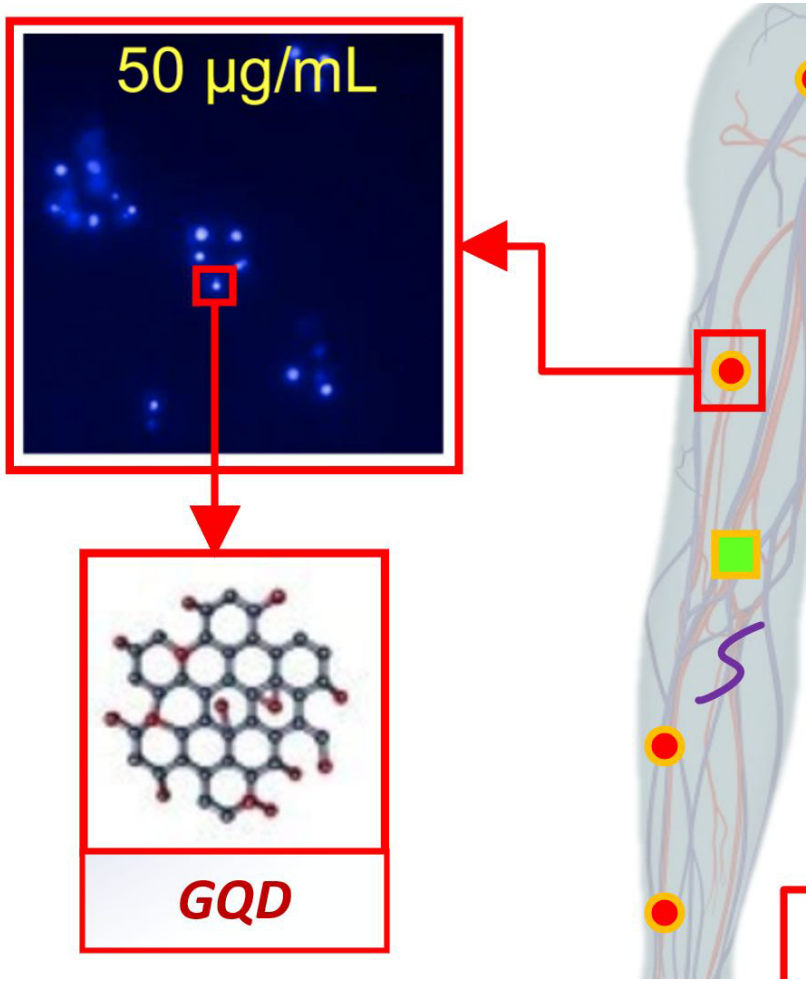


# Analysis of the intra-body network components




- Note how the **nanosensors attach** and conform to the artery wall and monitor the GQDs crossing it through the bloodstream.
- This model **can be repeated throughout the body**, circulatory system, and, probably, in the nervous system.

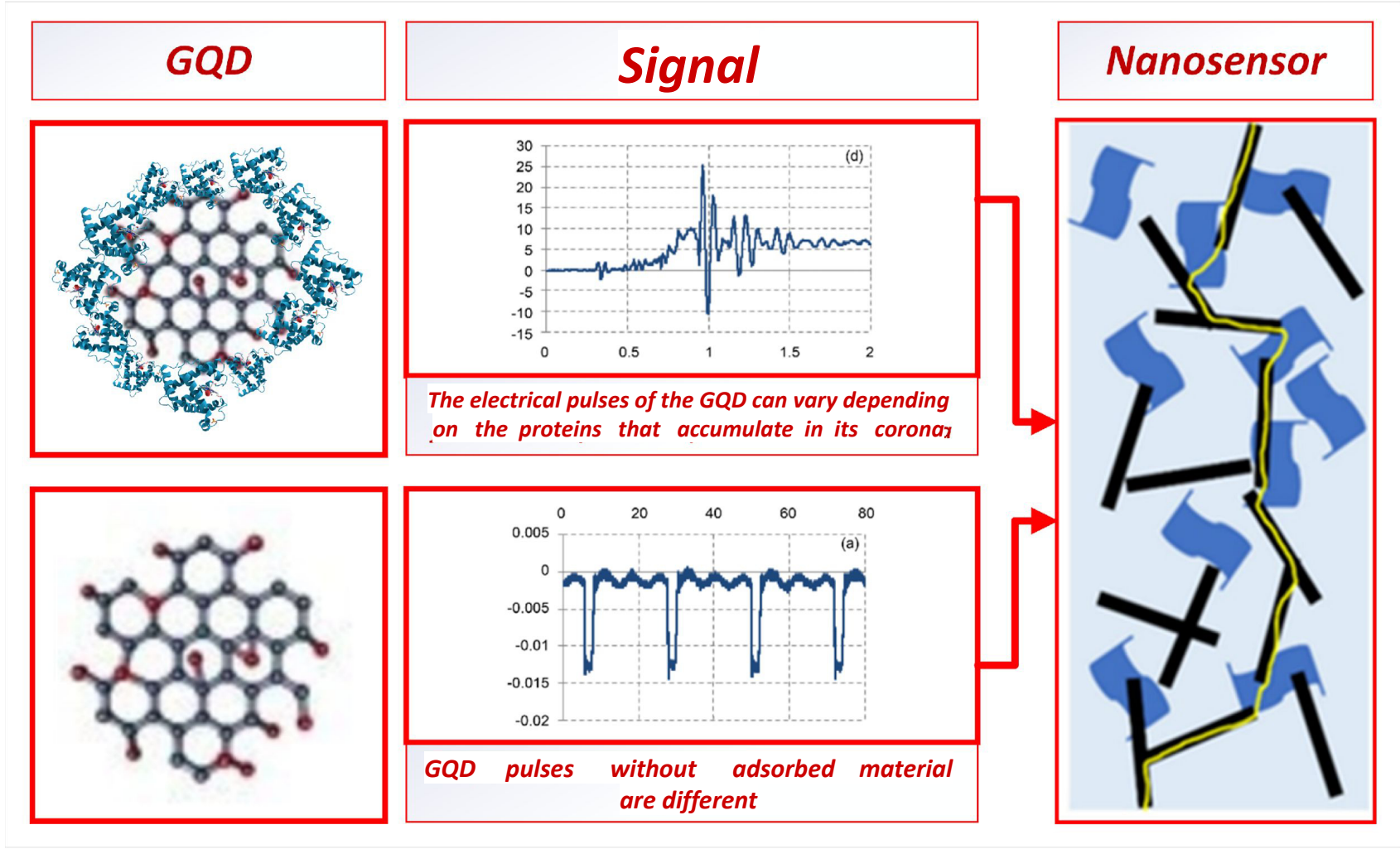
# Analysis of the intra-body network components




## Graphene Quantum Dots (GQD)

- Graphene quantum dots are micro-nanometer scale pieces of graphene or graphene oxide with circular, hexagonal, triangular... shapes that **arise from the decomposition or oxidation of graphene nanosheets**.
- The GQDs, far from being a defect in the network, play a fundamental role since their size allows them to function or operate as nano-antennas. But they also conduct through the circulatory system, arteries, veins, capillaries, **acting as electrical markers**, but also biological since they adsorb proteins and other components present in the blood.

# Analysis of the intra-body network components

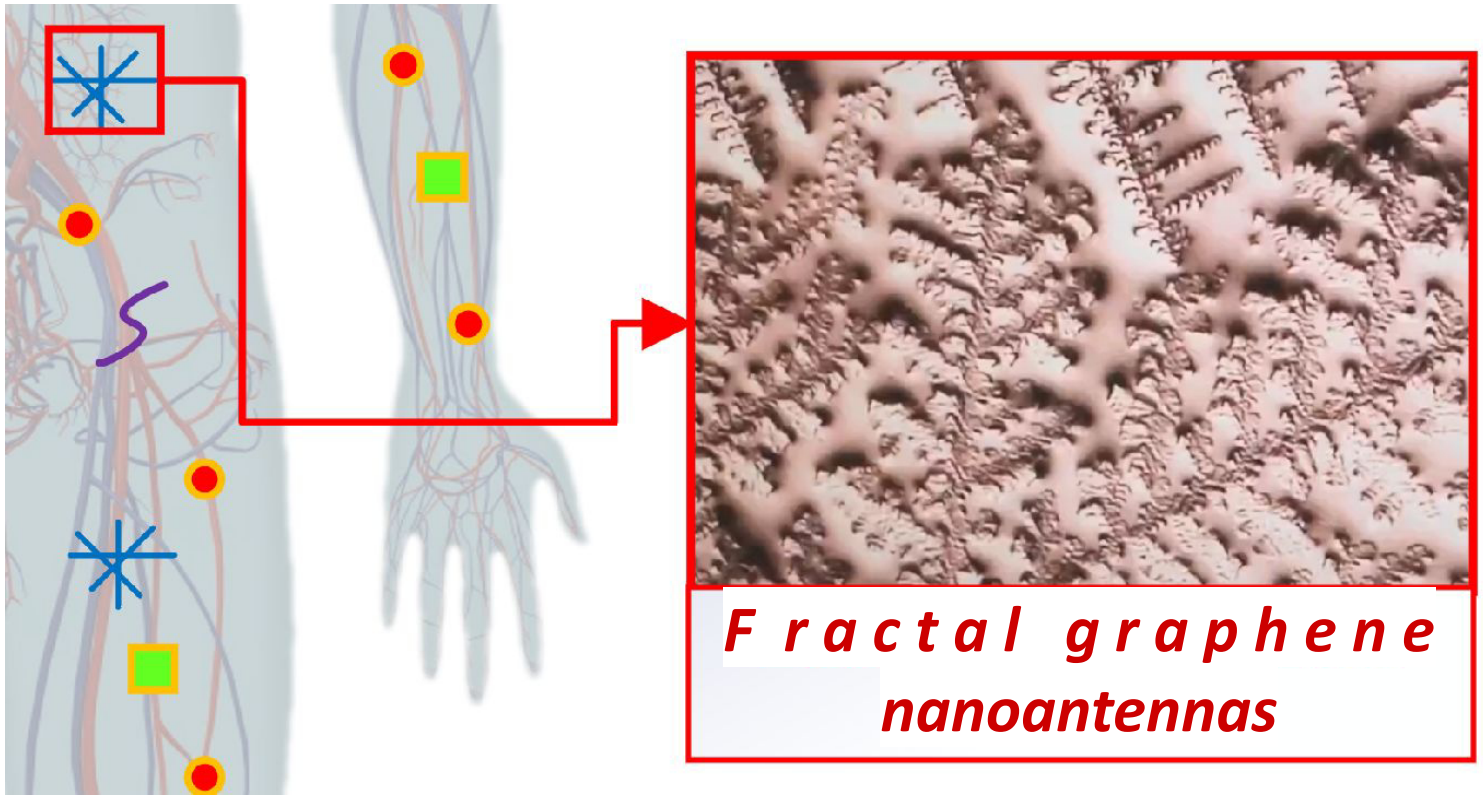



- The electrical pulses emitted by the GQDs **produce variations in the signal**, alterations that are picked up by nanosensors and retransmitted to the rest of the nano-network for propagation and emission.
- It must be understood that these signals **can be discerned and interpreted according to predefined mathematical patterns**.

# Analysis of the intra-body network components

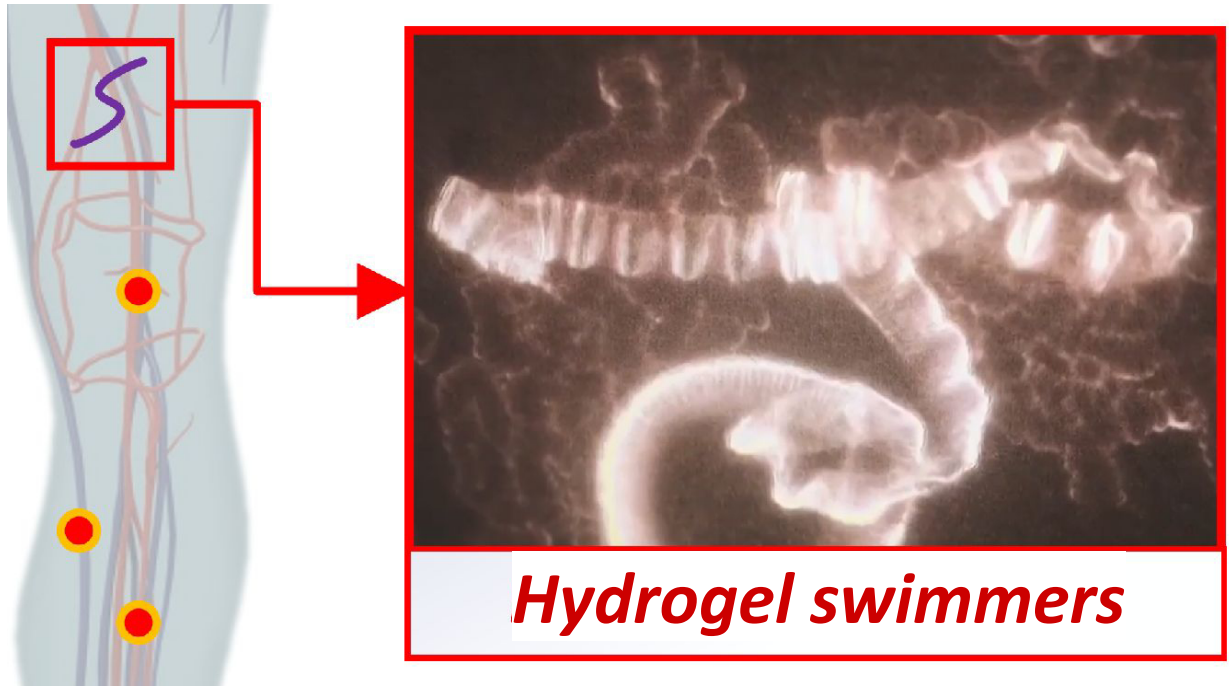
- Under certain conditions of temperature, pressure, and blood saturation, **crystallization of graphene nanosheets can occur**, **forming fractals**.
- Graphene fractals are **the best nanoantennas** in terms of capacity, bandwidth, frequency operating capacity, etc.
- When fixed to arterial and capillary walls, they **enhance the propagation effect** of the nano-network signals.

**Nanoantenas fractales de grafeno**



# Analysis of the intra-body network components

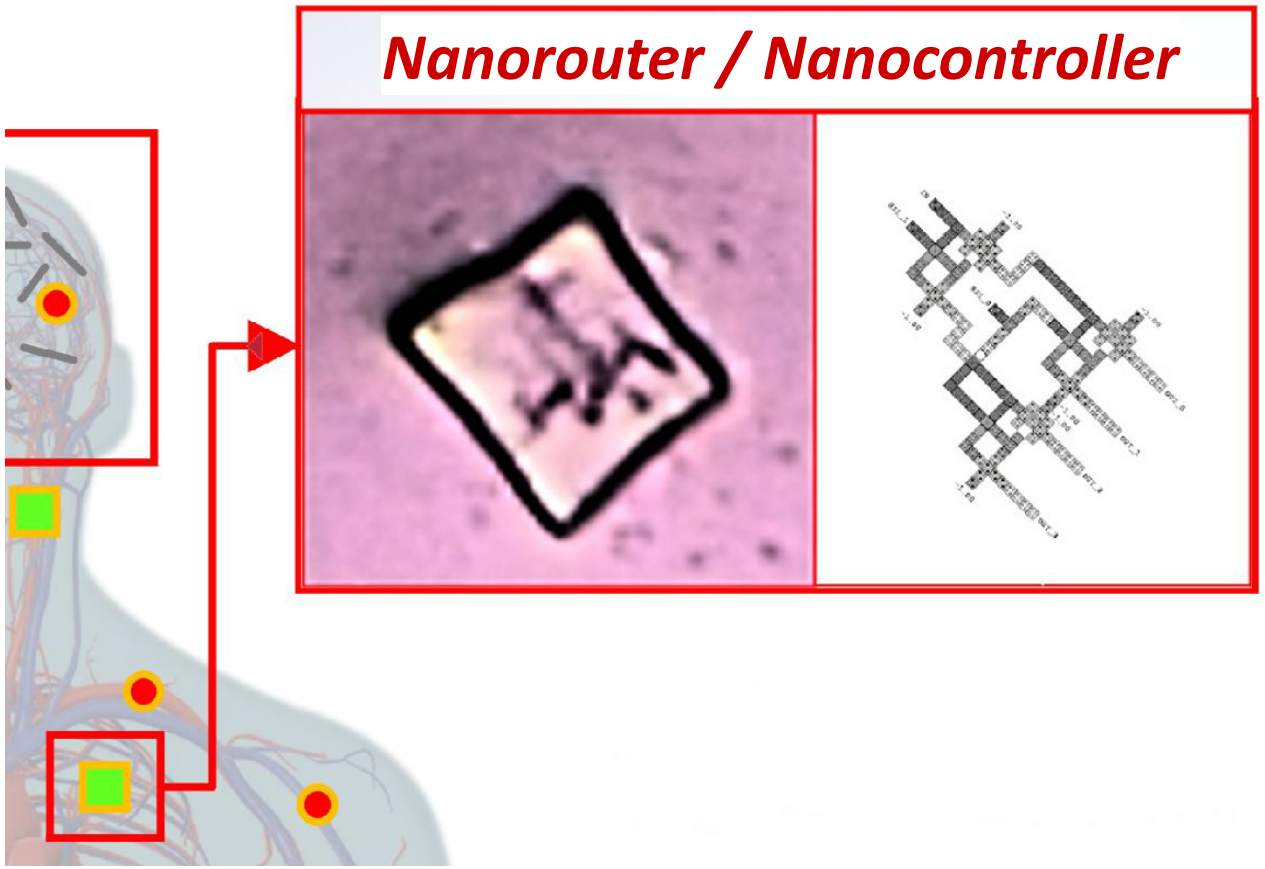
**Hydrogel swimmers / nano-ribbons**




- Hydrogel swimmers are, in fact, **ribbons of hydrogel and graphene**, which can articulate to generate movement through the body's circulatory system.
- They can release drugs, but also **propagate the nano-network signals to hard-to-reach areas** where nanoantennas cannot.
- They could play some role as **biosensors**. Some publications report this application.

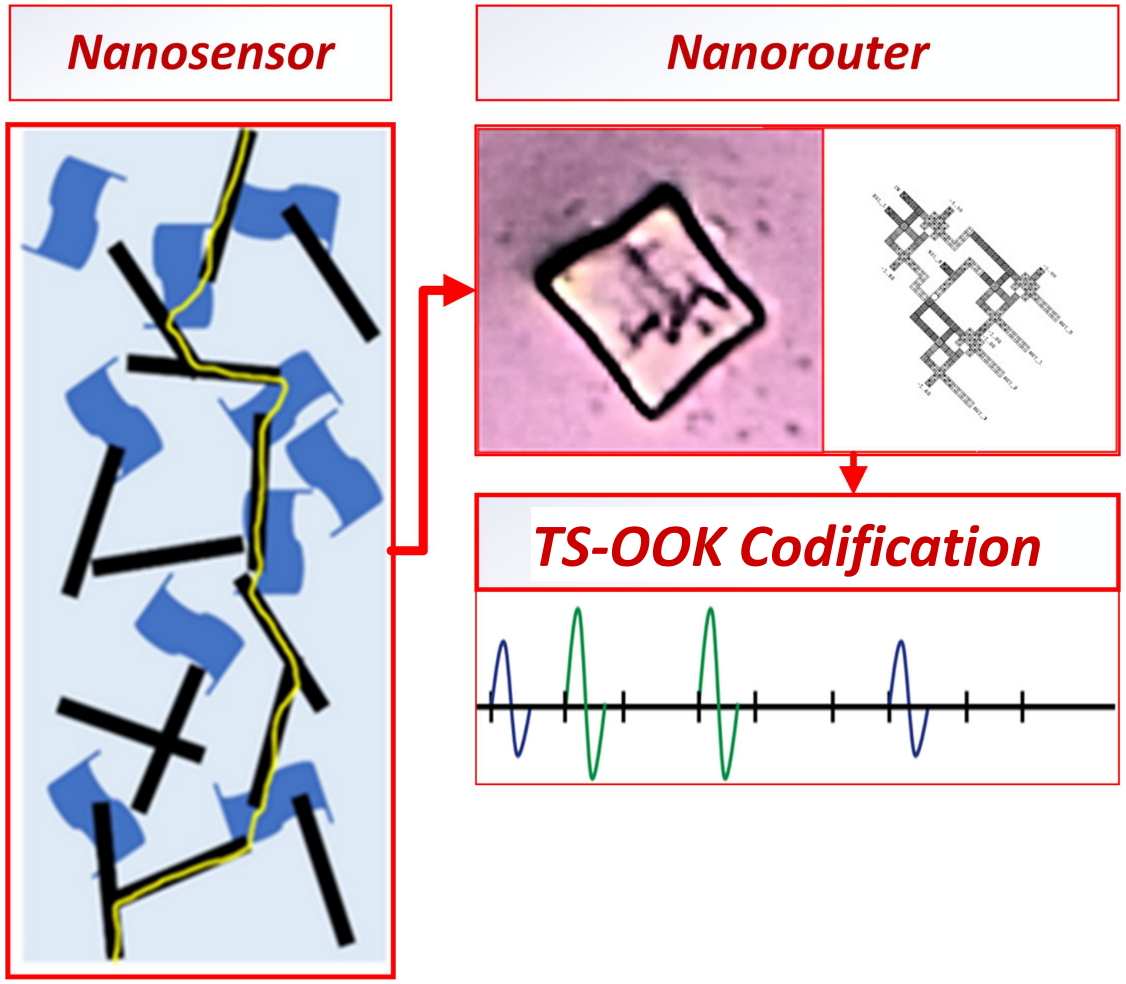
# Analysis of the intra-body network components

**Nanorouters**




- It's almost certain that the nano-network **operates with multiple nanorouters** that are distributed throughout the body, fixing themselves in areas with preferential electrical activity. For example, the endothelium, heart, lungs, arteries...
- It's quite likely that **each nanorouter has its own MAC addresses**, stored in memory circuits, which would explain their dynamic operation.
- The ideal concept is for the nanorouters to be located **close to the regions with nanosensors and nanoantennas** in order to receive the electrical pulse signals.

# Analysis of the intra-body network components

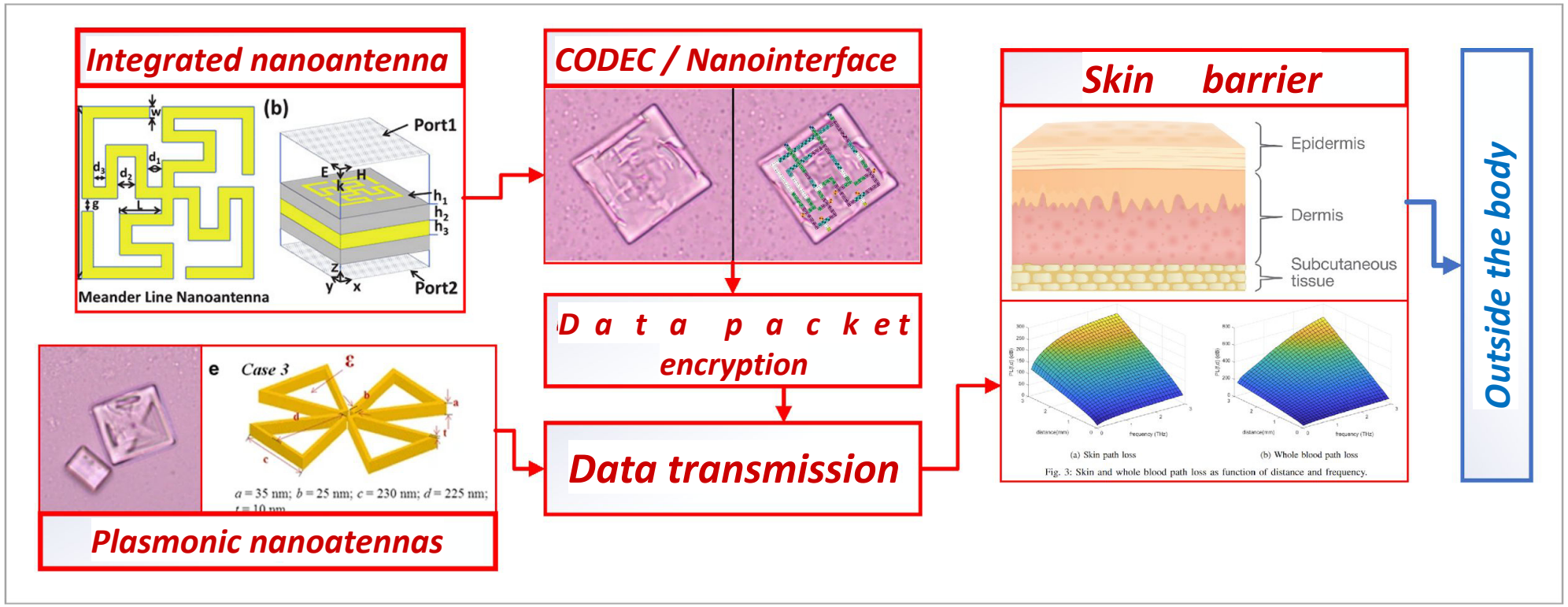



- When the nanorouter receives the signals, **it manages to encode them into TS-OOK** and route them as data packets for transmission. The TS-OOK signals have a binary pattern that is easy to interpret and transmit, which increases the data transmission capacity and the bandwidth that can be supported in the nano-network.
- The nanorouter **doesn't need a processor to operate**, as the QCA (quantum dot) architecture allows it to operate at a clock frequency, just as a computer processor would.
- In this way, **signals are transmitted to the nearest nanorouter** to optimize the nano-network and avoid signal saturation. For this reason, several of these components are envisaged, seated thanks to the hydrogel.

# Analysis of the intra-body network components

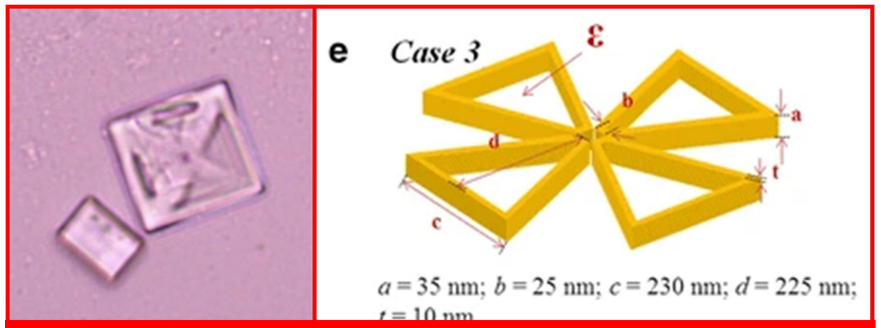
**Nanointerface**

- The nanointerface is **a more complex QCA circuit**, which contains a nanoantenna for transmitting and receiving TS-OOK signals. With high probability, **it has a CODEC to encrypt the data packets** and retransmit them to the outside.

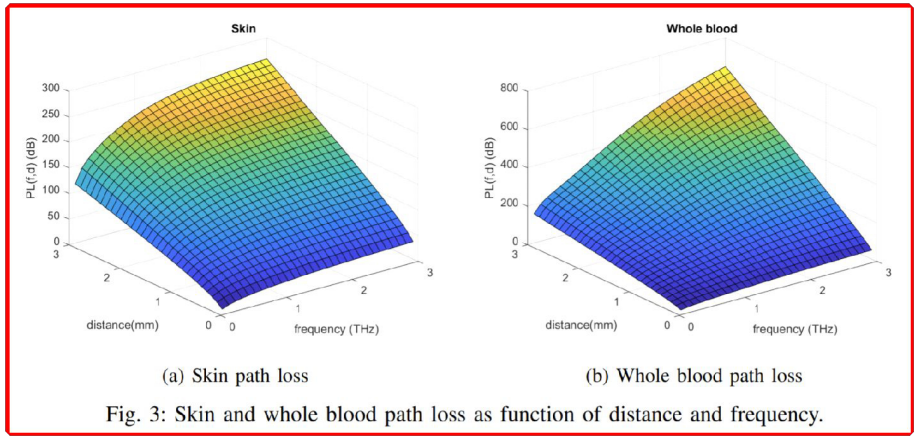


# Analysis of the intra-body network components

- The nanointerface, like the nanorouter, can be made up of **several levels or layers**, of which only the outermost one is visible under the microscope. This doesn't make it easy to find out its functions.
- The **encryption of the data is understandable** due to the sensitivity and privacy of the information to add layers of security to prevent bio-hacking.
- Alongside the CODEC QCA, plasmonic **nanoantennas have been found, that serve to boost and repeat the emission of the nanointerface**. This is important for transmitting encrypted data packets outside the body. To do so, the skin barrier (dermis, epidermis...) must be overcome.




***Plasmonic nanoatennas***




(a) Skin path loss (b) Whole blood path loss

Fig. 3: Skin and whole blood path loss as function of distance and frequency.

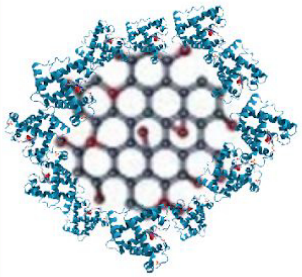
# Intra-body nano-communication process

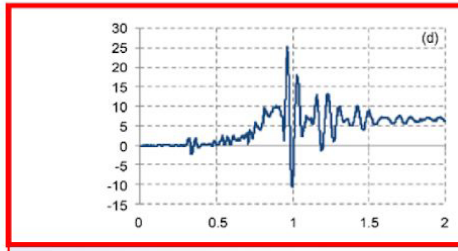
GQD

Signal

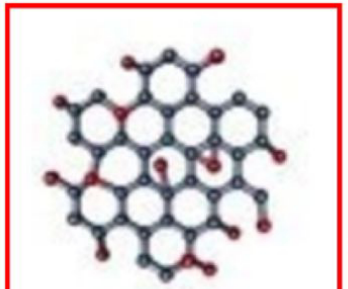
Nanosensor

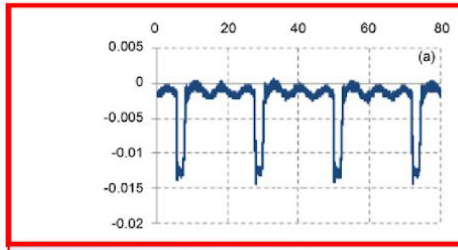
Nanorouter



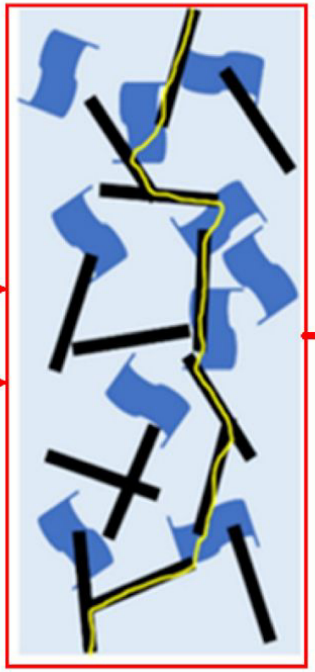


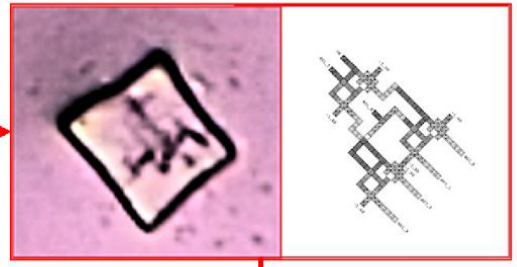

The electrical pulses of the GQD can vary depending on the proteins that accumulate in its corona



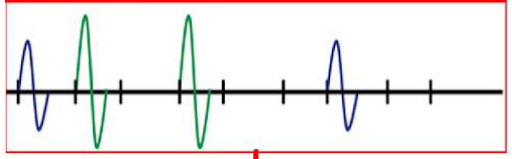



GQD pulses without adsorbed material are different

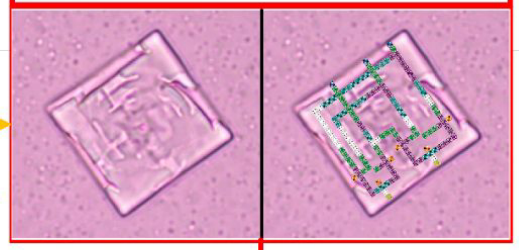




TS-OOK Codification



CODEC / Nanointerface

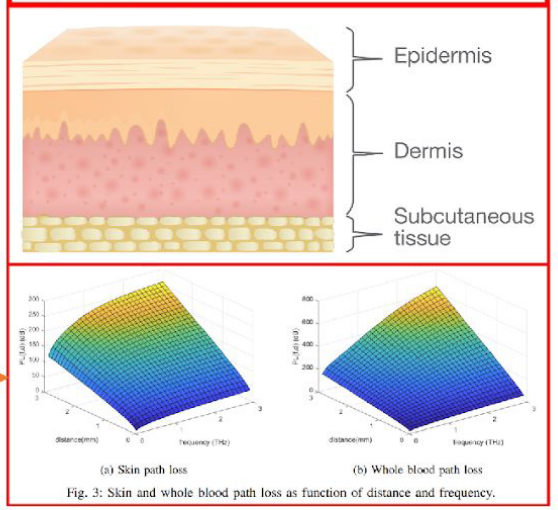


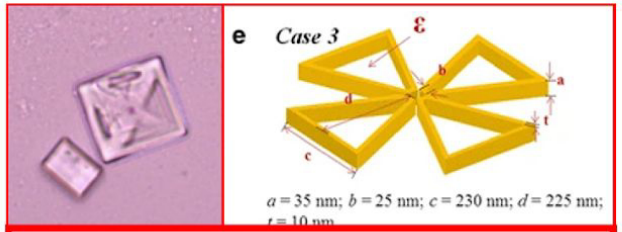
Data packet encryption

Data transmission

Outside the body

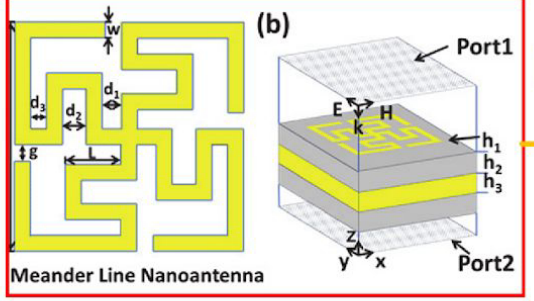
Skin barrier



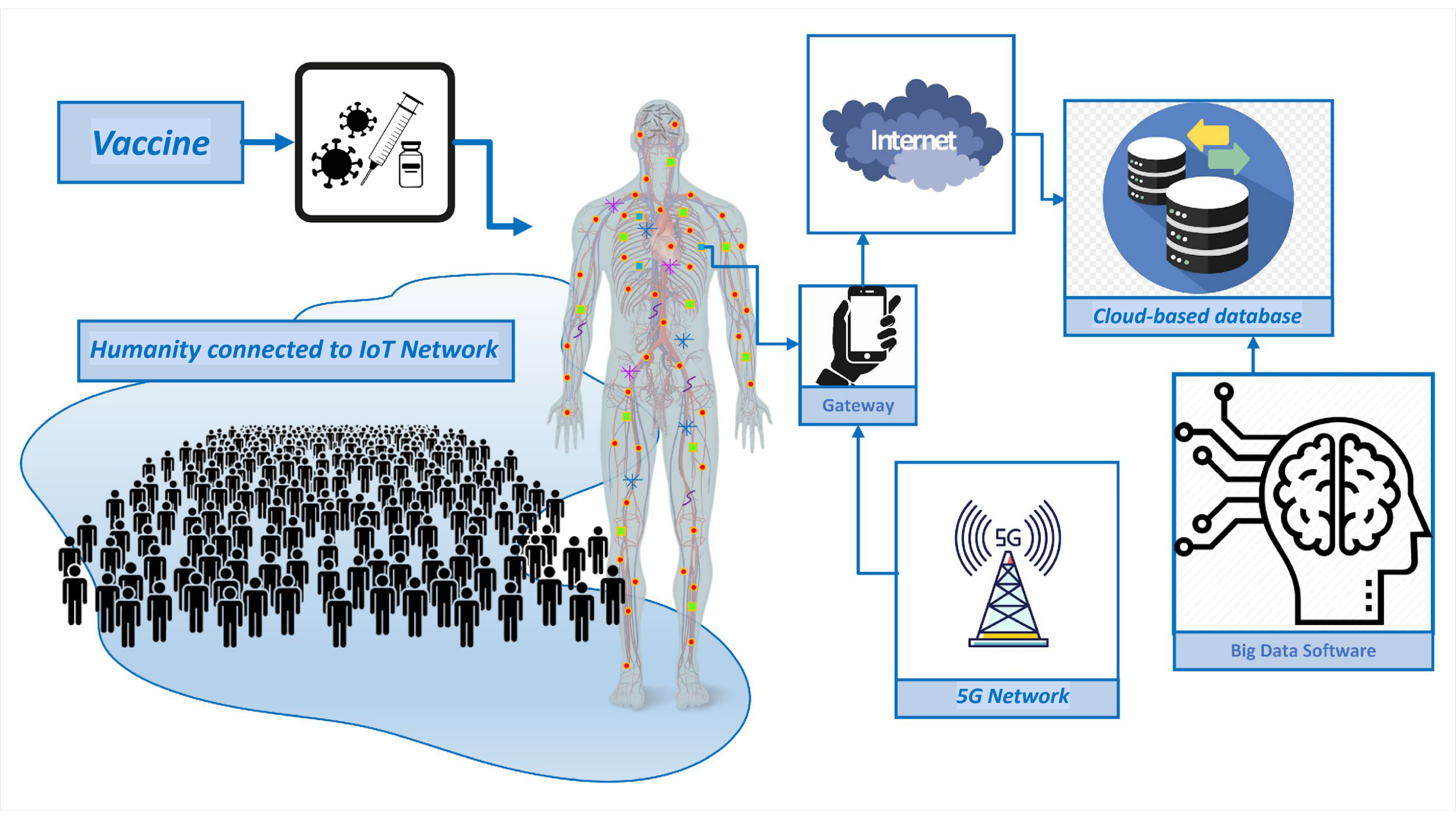

Plasmonic nanoatennas

Integrated nanoatenna




INPUT

OUTPUT


Vaccine
Humanity connected to IoT Network
Internet
Gateway
Cloud-based database
5G
5G Network
Big Data Software